Compared sensitivity of VLT, JWST and ELT for direct exoplanet detection in nearby stellar moving groups

Charles Hanot, Olivier Absil, Jean Surdej, Anthony Boccaletti

In the context of exoplanet detection, a large majority of the 400 detected exoplanets have been found by indirect methods. Today, progress in the field of high contrast imaging has allowed direct images of several exoplanetary systems to be taken (e.g., for HR 8799 and Fomalhaut). In the near future, several new instruments will dramatically improve our sensitivity to exoplanet detection. Among these, SPHERE at the VLT, MIRI onboard JWST and EPICS at the future E-ELT will be equipped with coronagraphs to reveal faint objects in the close vicinity of nearby stars.

We have used the Lyon group (*COND*) evolutionary models of young (sub-) stellar objects and exoplanets to compare the sensitivity of these different instruments using their estimated coronagraphic profiles. From this comparison, we present a catalogue of targets which are particularly well suited for each instrument. Our study identifies a very interesting niche for the MIRI instrument onboard JWST. This niche consists in the observation of nearby M-stars located in young moving groups. Indeed in most cases, such M-stars are too faint to be used as guide stars for the (extreme) adaptive optics systems that will equip future ground-based planet imagers. Therefore, only MIRI will provide a good sensitivity to faint companions around these targets, down to Neptune-mass planets in the most favorable cases. We show however that for earlier stellar types (i.e, A, F, G and K), SPHERE and EPICS will be on par with, or will outperform MIRI.

We therefore conclude that these three instruments are very complimentary for exoplanet imaging as they will probe different angular separations and will be optimal for different types of stars (see Figure 1).

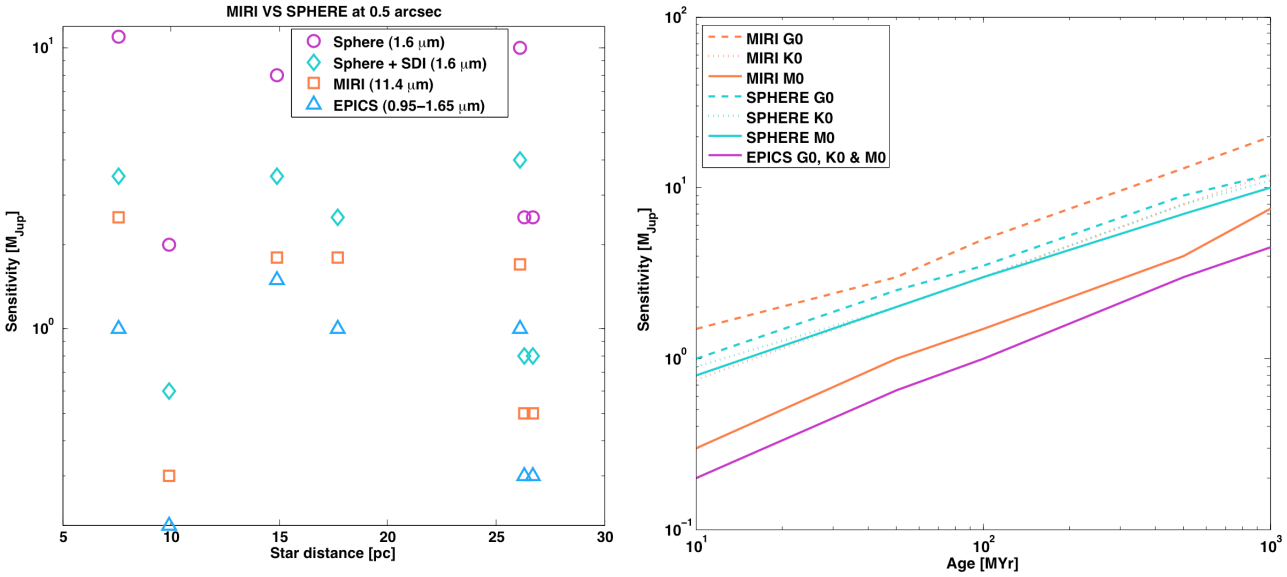

Figure 1. *(Left)*. Comparison of the MIRI, SPHERE and EPICS sensitivities for low-mass companions around M stars in young moving groups that are bright enough to be observed from the ground. *(Right)*. Sensitivities as a function of age for three stellar types, at a distance of 20pc and for an angular separation of 0.5" (0.4" for EPICS).